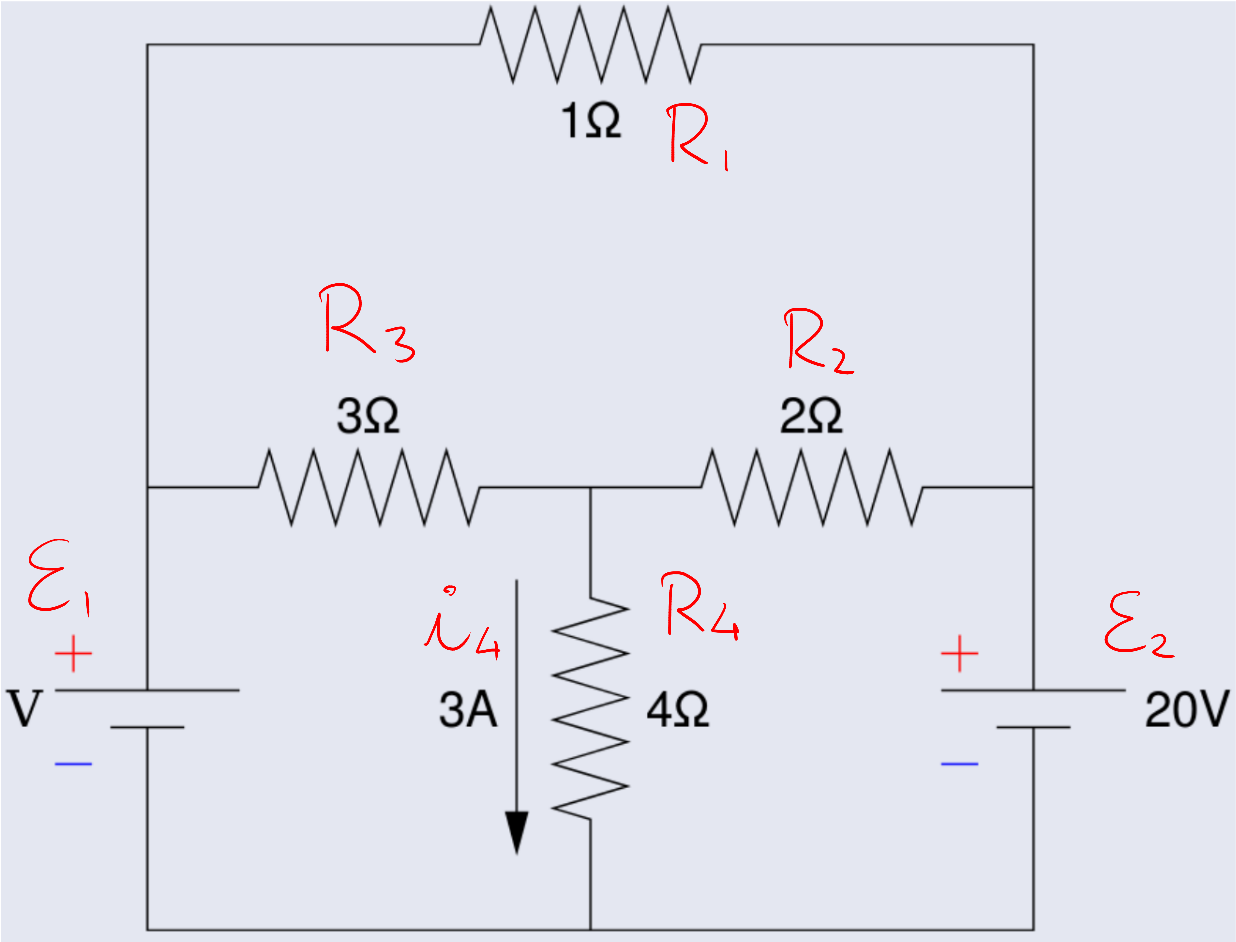
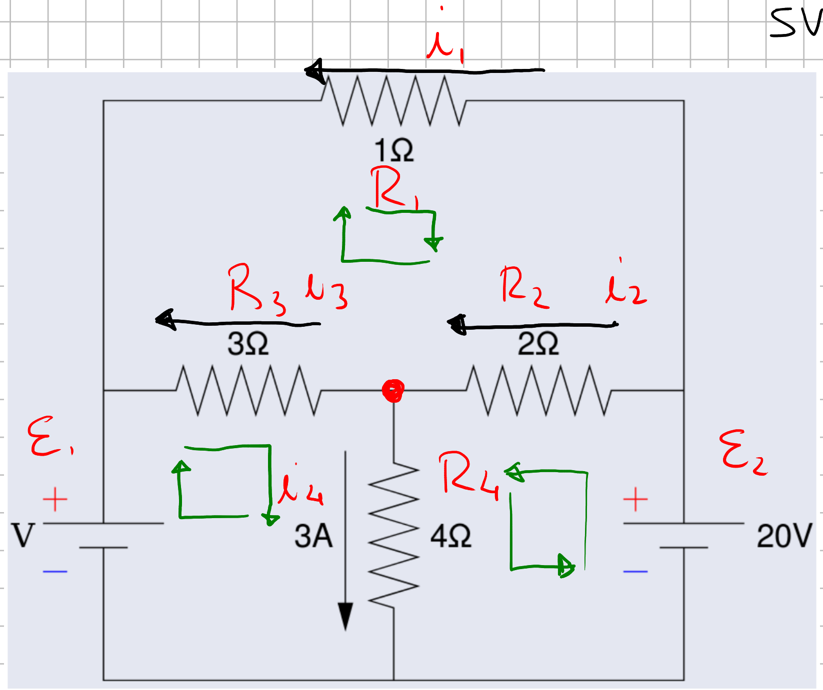
ESERCIZIO 66

Dato il circuito in figura ($R_1 = 1\,\Omega$, $R_2 = 2\,\Omega$, $R_3 = 3\,\Omega$, $R_4 = 4\,\Omega$, $i_4 = 3$ A, $\mathcal{E}_2 = 20$ V)



1. Calcolare la corrente che scorre nei resistori
2. Calcolare la forza elettromotrice $\mathcal{E}_1$ del generatore di sinistra
3. Cosa cambierebbe se al posto di R_1 ci fosse un condensatore di capacità C?



SVOLGIMENTO

SOMMA SUI RAMI

$$\sum_k i_k = 0 \quad , \quad \sum_k \mathcal{E}_k = \sum_k R_k i_k$$

① $\mathcal{E}_2 = R_2 i_2 + R_4 i_4 \Rightarrow i_2 = \dfrac{\mathcal{E}_2 - R_4 i_4}{R_2} = \dfrac{20-12}{2} =$

$= 4\,A$

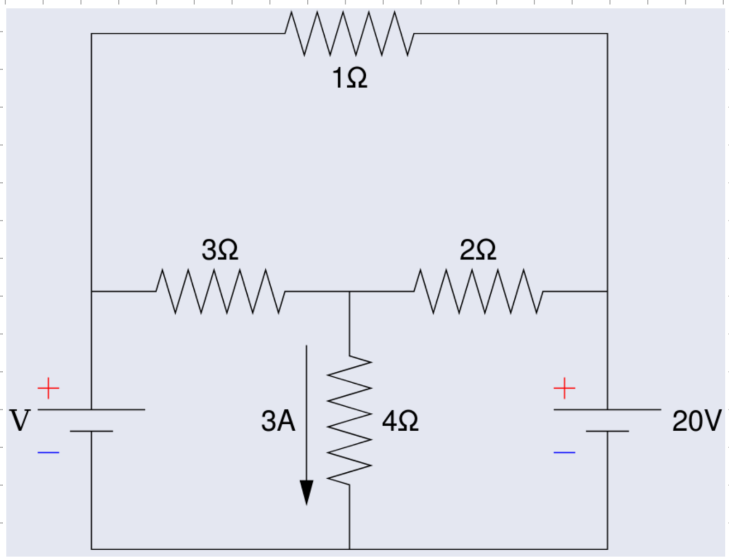
② $i_2 - i_4 + i_3 = 0 \Rightarrow i_3 = i_4 - i_2 = -1\,A$

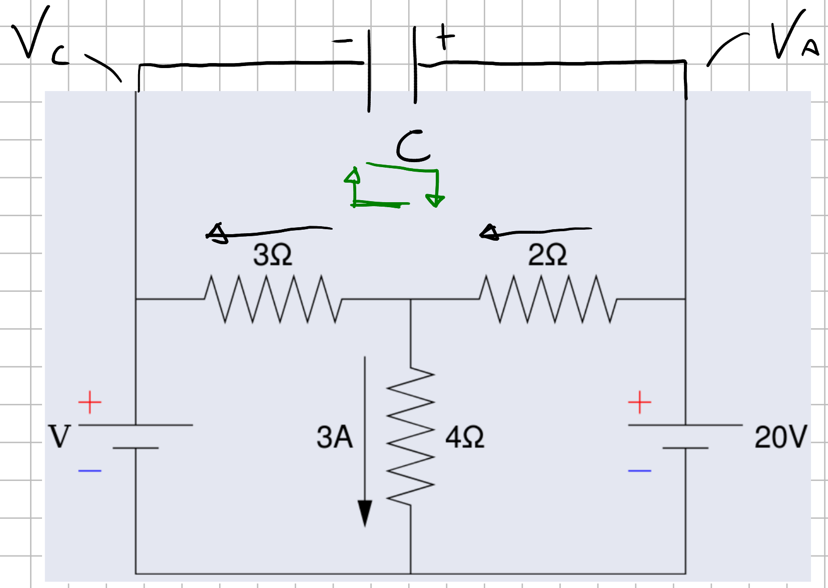
③ $0 = R_2 i_2 + R_3 i_3 + R_1 i_1 \Rightarrow$

$$i_1 = -\frac{R_2 i_2 + R_3 i_3}{R_1} = -\frac{8+3}{1} = -11\,A$$

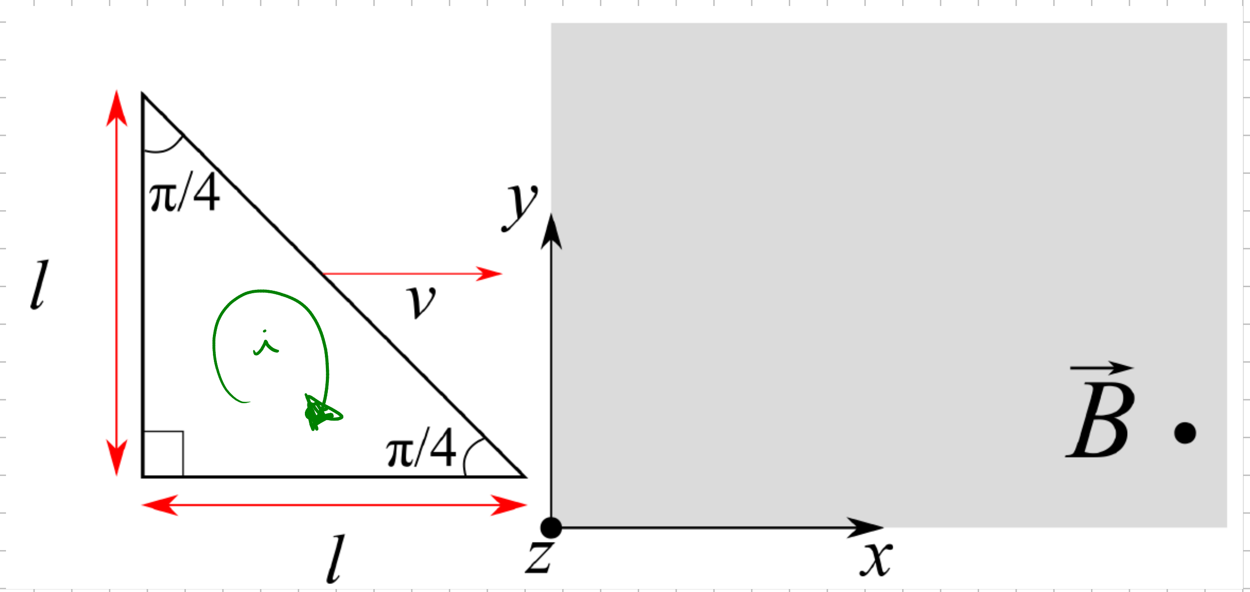
④ $\mathcal{E}_1 = -R_3 i_3 + R_4 i_4 = -3 + 12 = 9\,V$

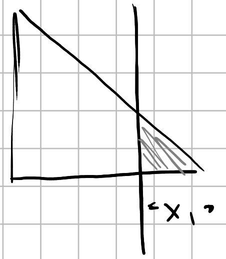
$\mathcal{E}_1 - \mathcal{E}_2 = -R_1 i_1 \Rightarrow \mathcal{E}_1 = \mathcal{E}_2 - R_1 i_1 = 20 - 11 = 9\,V$

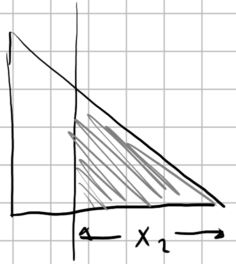




$$0 = R_2 i_2 + R_3 i_3 + \Delta V_c \Rightarrow \Delta V_c = -(R_2 i_2 + R_3 i_3) = -11V$$







$x(t) = vt \ , \ A(t) = \frac{1}{2} x^2(t)$

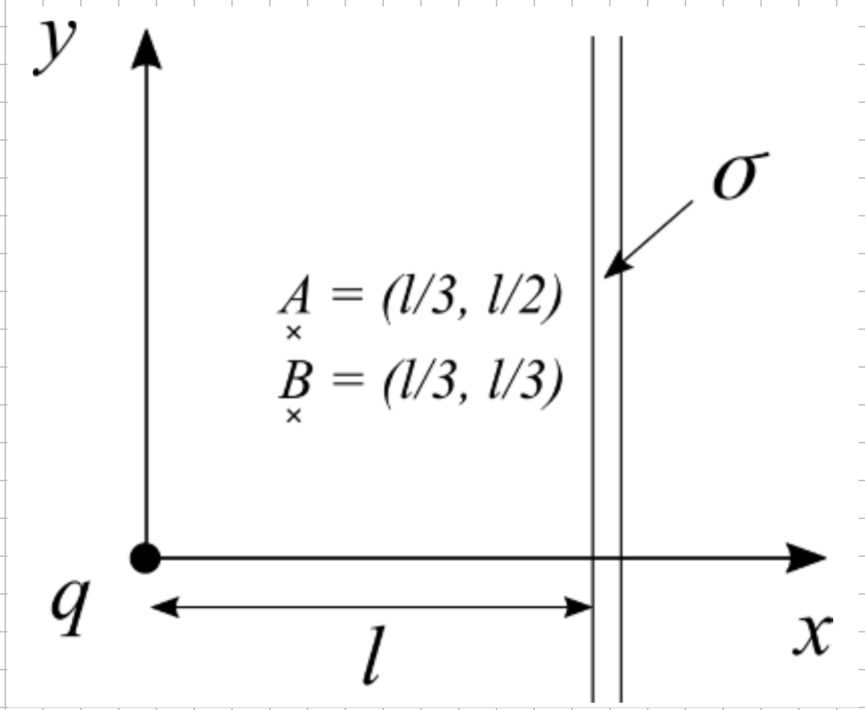
$\Phi(\vec{B}) = BA(t) = \frac{1}{2} B x^2(t) = \frac{1}{2} B v^2 t^2$

$\mathcal{E}_i = -\frac{d\Phi}{dt} = -Bv^2 t$

$i = \frac{|\mathcal{E}_i|}{R} = \frac{Bv^2 t}{R}$

$x(t) = vt \ , \quad l = v t_f \Rightarrow t_f = \frac{l}{v}$

$Q = \frac{\Phi_1 - \Phi_2}{R} = -\frac{\Phi_2}{R} = -\frac{\frac{1}{2} l^2 B}{R}$



① $\vec{E}(A) = \vec{E}_p + \vec{E}_c$, $\vec{E}_p = \frac{\sigma}{2\varepsilon_0}(-\hat{x}) = -\frac{\sigma}{2\varepsilon_0}\hat{x}$

$\vec{E}_c = \frac{q}{4\pi\varepsilon_0}\frac{\hat{r}_A}{r_A^2}$, $\vec{r}_A = \left(\frac{l}{3}, \frac{l}{2}\right)$, $r_A = \sqrt{\frac{l^2}{9} + \frac{l^2}{4}} = \frac{\sqrt{13}}{6} l$

$\hat{r}_A = \frac{\vec{r}_A}{r_A} = \frac{6}{\sqrt{13}\, l}\left(\frac{l}{3}, \frac{l}{2}\right) = \frac{1}{\sqrt{13}}(2,3)$

$\Rightarrow \vec{E}_c = \frac{q}{\cancel{4}\pi\varepsilon_0}\,\frac{\overset{9}{\cancel{36}}}{13 l^2}\,\frac{1}{\sqrt{13}}(2,3) = \frac{9q}{\pi\varepsilon_0}\,\frac{(2,3)}{13\sqrt{13}\, l^2} \Rightarrow$

$$\vec{E}(A) = \left(\frac{18q}{\pi\varepsilon_0}\frac{1}{13\sqrt{13}\, l^2} - \frac{\sigma}{2\varepsilon_0}, \frac{27q}{\pi\varepsilon_0}\frac{1}{13\sqrt{13}\, l^2}\right)$$

② $\Delta V_{AB} = \Delta V_{AB}^{c} = \frac{q}{4\pi\varepsilon_0}\left(\frac{1}{r_B} - \frac{1}{r_A}\right)$, $r_B = \frac{\sqrt{2}}{3} l$